

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors: Peter G. Borden; Ji-Ping Li
Assignee: Applied Materials, Inc.
Title: Identifying Defects In A Conductive Structure Of A Wafer, Based On Heat Transfer Therethrough
Serial No.: 10/090,287 Filing Date: March 1, 2002
Examiner: Verbitsky, Gail Group Art Unit: 2859
Docket No.: BOX014 US Confirmation No: 6609

01/02/2004 JADD01
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Santa Clara, California
December 23, 2003

COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.97(c)**

Dear Sir:

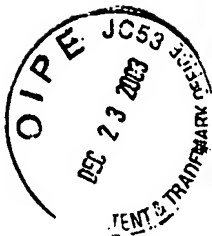
Pursuant to 37 C.F.R. § 1.56, §1.97 and §1.98, the Applicants submit for consideration in the above-identified patent application the document listed on the accompanying Form PTO-1449. Copies of references numbered 9-18, 27-32, 41-46, 55-62, 71-77, 86-92, and 101-111 are submitted herewith. The Examiner is requested to make these documents of record. The remaining references are not attached hereto, because these references are issued patents which are readily available in the U.S. Patent and Trademark Office.

This Information Disclosure Statement is submitted pursuant to 37 CFR §1.97(c) as it is after receipt of a first Office Action on the merits but before mailing of a final Action or Notice of Allowance. Accordingly, a fee is required pursuant to 37 CFR §1.17(p). A Fee Transmittal form (PTO/SB/17) is attached to this submission.

Applicants would appreciate the Examiner initialing and returning the Form PTO-1449, indicating that the information has been considered and made of record herein.

In addition, Applicants submit, for the Examiner's consideration, the prosecution histories of the following co-owned applications/patents, cited by serial number, first named inventor and filing date. The Applicants presume that the Examiner has access to

SILICON VALLEY
PATENT GROUP LLP
2350 Mission College Blvd.
Suite 360
Santa Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210



and will review the applications/patents and the files thereof for any office actions, amendments or other materials that may be relevant to the patentability of the claims of the present application. For any such U.S. patent application(s) that are currently pending, the Applicants further presume that the Examiner will consider any future office actions, amendments or other materials in the file thereof that may be relevant to the patentability of the claims herein. **If the Applicants' understanding in this regard is not correct, please notify the undersigned so that copies of any such documents can be submitted to the Examiner.**

	Serial No.:	First Named Inventor	Date:
1.	10/090,316	Peter G. Borden	03/01/2002 ✓
2.	09/974,571	Peter G. Borden	10/09/2001 ✓
3.	10/090,287	Peter G. Borden	03/01/2002 ✓
4.	09/521,232	Peter G. Borden	03/08/2000 ✓
5.	10/090,262	Peter G. Borden	03/01/2002 ✓
6.	09/788,273	Peter G. Borden	02/16/2001 ✓
7.	10/722,724	Peter G. Borden	11/25/2003 ✓
8.	09/095,805	Peter G. Borden	06/10/1998 <i>not patent</i>


The information contained in this Information Disclosure Statement is to the best of my knowledge and is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to the examination of this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

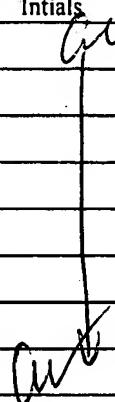
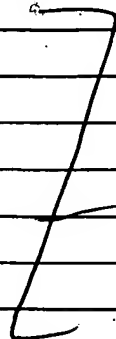
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Respectfully submitted,

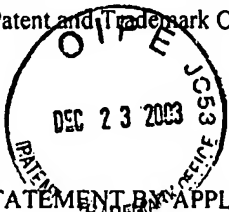
Omkar K. Suryadevara
Attorney for Applicants
Reg. No. 36,320

SILICON VALLEY
PATENT GROUP LLP
2350 Mission College Blvd.
Suite 360
Santa Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210

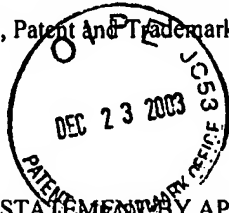
U.S. Department of Commerce, Patent and Trademark Office  INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use several sheets if necessary)	Application No.:	10/090,287
	Filing Date:	March 01, 2002
	First Named Inventor:	Peter G. Borden
	Group Art Unit:	2859
	Examiner Name:	Verbitsky
	Confirmation No.:	6609
	Attorney Docket No.:	BOX014 US

U.S. Patent Documents								
*Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate	
	1.	6,489,801	12/3/02	Borden et al.	324	766		
	2.	5,966,019	10/12/99	Borden	324	752		
	3.	5,377,006	12/27/94	Nakata	356	349		
	4.	6,323,951	11/27/01	Borden et al.	356	502		
	5.	6,426,644	7/30/02	Borden et al.	324	765		
	6.	5,042,951	8/27/91	Gold et al.	356	369		
	7.	5,159,412	10/27/92	Willenborg et al.	356	445		
	8.	5,181,080	1/19/93	Fanton et al.	356	381		
Foreign Patent Documents								
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		Document	Date	Country	Class	Subclass	Yes	No
	9.	97/08536	06.03.97	WO	G01N	21/00		
	10.	0 718 595	20.12.95	Europe	G01B			
	11.	2000009443A	1/1/2000	Japan	G01B			
	12.	99/64880	16.12.1999	PCT	G01R	31/26		
	13.	05006929A	Jan-93	Japan	H01L	21/66		
Other Art (Including Author, Title, Date, Pertinent Pages, Etc.)								
	14.	Jackson, "Classical Electrodynamics", John Wiley & Sons, Inc., (month unavailable), 1967, pp. 222-226						
	15.	Rosencwaig et al. "Detection of Thermal Waves Through Optical Reflectance", Appl Phys. Lett. 46, June 1985, pp1013-1015						
	16.	Rosencwaig, "Thermal-Wave Imaging", SCIENCE, Volume 218, No. 4569, Oct. 1982, pp.223-228						
	17.	Opsal et al. "Thermal-Wave Detection and Thin-Film Thickness Measurements with Laser Beam Deflection", Applied Optics, Vol. 22, No. 20, Oct. 1983, pp. 3169-3176						
	18.	Rosencwaig, "Thermal Wave Characterization and Inspection of Semiconductor Materials and Devices", Chapter 5 (pp. 97-135) of Photoacoustic and Thermal Wave Phenomena in Semiconductors, North Holland (month unavailable) 1987						

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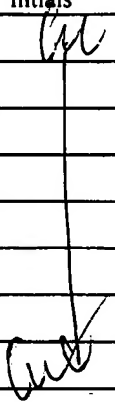
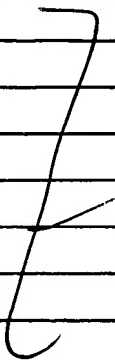
U.S. Patent Documents							
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[Handwritten initials]	19.	4,579,463	4/1/86	Rosencwaig et al.	374	57	[Handwritten checkmark]
	20.	4,632,561	12/30/86	Rosencwaig et al.	356	432	
	21.	4,636,088	1/13/87	Rosencwaig et al.	374	5	
	22.	6,049,220	4/11/00	Borden et al.	324	765	
	23.	6,483,594	11/19/02	Borden et al.	356	502	
	24.	5,652,716	7/29/97	Battersby	703	13	
	25.	5,761,082	6/2/98	Miura-Mattausch	703	14	
	26.	4,996,659	2/26/91	Yamaguchi et al.	714	736	
Foreign Patent Documents							
							Translation
		Document	Date	Country	Class	Subclass	Yes No
Other Art (Including Author, Title, Date, Pertinent Pages, Etc.)							
	27.	"Process Monitoring System," Quantox Product Brochure, 3 pg, prior to June 10, 1998					
	28.	J. Opsal, "High Resolution Thermal Wave Measurements and Imaging of Defects and Damage in Electronic Materials" Photoacoustic and Photothermal Phenomena II, Springer Series in Optical Sciences, Vol. 62, Springer Verlag Berlin, Heidelberg, 1990.					
	29.	J. Kolzer et al "Thermal Imaging and Measurement Techniques for Electronic Materials and Devices" Microelectronic Engineering, vol. 31, 1996 (month unknown) pages 251-270					
	30.	C. Martinsons et al. "Recent progress in the measurement of thermal properties of hard coatings" Thin Solid Films, vol. 317, April 1998, 455-457.					
	31.	S. Wolf and R. N. Tauber, "Silicon Processing For The VLSI Era", Volume 1, 1986, pages 388-399					
	32.	Yaozhi Hu and Sing Pin Tay, "Spectroscopic ellipsometry investigation of nickel silicide formation by rapid thermal process", J. Vac. Sci. Technology, American Vacuum Soc. May/Jun 1998, pages 1820-1824					
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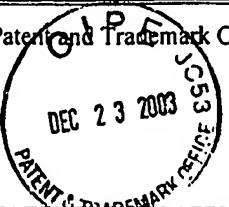
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*Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate	
mi	33.	6,154,280	11/2/00	Borden	356	376	7	
	34.	6,054,868	4/25/00	Borden et al.	324	752		
	35.	5,883,518	3/16/99	Borden	324	752		
	36.	5,877,860	3/2/99	Borden	356	376		
	37.	5,978,074	11/2/99	Opsal et al.	356	72		
	38.	5,574,562	11/12/96	Fishman et al.	356	432		
	39.	6,169,601	1/2/01	Eremin et al.	356	240		
mi	40.	6,489,624	12/3/02	Ushio et al	250	559		
Foreign Patent Documents								
							Translation	
		Document	Date	Country	Class	Subclass	Yes	No
Other Art (Including Author, Title, Date, Pertinent Pages, Etc.)								
	41.	<u>Quality Today News, article entitled "In-Line Metrology SEM System with 3D Imaging" dated January 10, 2000 and published at http://www.qualitytoday.com/Jan-00-news/011000-3.htm before April 4, 2001</u>						
	42.	Bristow, Thomas C. and Dag Lindquist, "Surface Measurements With A Non-Contact Nomarski-Profilng Instrument", Interferometric Metrology, SPIE vol. 816, August 1987, pages 106-110						
	43.	Walter G. Driscoll and William Vaughan, "Handbook of Optics", 1978, pages 8-42, 8-43, 8-107, and 10-72 to 10-77						
	44.	Charles Kittel, "Introduction to Solid State Physics", Fourth Edition, John Wiley & Sons, published prior to March 1, 2002, pages 262-264						
	45.	Rolf E. Hummel, "Electronic Properties of Materials, An Introduction For Engineers", published prior to March 1, 2002, pages 137-145						
	46.	H.S. Carslaw and J.C. Jaeger, "Conduction of Heat In Solids", Second Edition, published prior to March 1, 2002, pages 64-66						

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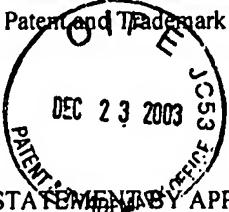
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	47.	6,486,965	11/26/02	Kim	356	626		
	48.	5,741,614	4/21/98	McCoy et al.	430	30		
	49.	6,327,035	12/4/01	Li et al.	356	432		
	50.	5,454,004	9/26/95	Leger	372	99		
	51.	6,281,027	9/28/01	Wei et al.	438	14		
	52.	4,975,141	12/4/90	Greco et al.	156	626		
	53.	6,395,563	5/28/02	Eriguchi	438	7		
	54.	4,950,990	8/21/90	Moulder	324	224		
Foreign Patent Documents								
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		Document	Date	Country	Class	Subclass	Yes	No
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	55.	"Process Monitoring System", Quantox Product Brochure, 3 pages, published prior to March 1, 2002						
	56.	A. Rosencwaig, "Thermal Wave Measurement of Thin-Film Thickness", 1986 American Chemical Society, pp.182-191						
	57.	"Thin-Film Thickness Measurements with Thermal Waves", Journal De Physique, October 1983, pp. C6-483 - C6-489						
	58.	W. L. Smith et al. "Thermal-wave Measurements and Monitoring of TaSi _x Silicide Film Properties" J. Vac. Technol. B2(4), Oct.-Dec. 1984, pp. 710-713						
	59.	A. Salnick et al., "Nonlinear Fundamental Photothermal Response in 3D Geometry: Experimental Results for Tungsten (believed to be prior to March 01, 2002)."						
	60.	S. Ameri et al., "Photo-Displacement Imaging", March 30, 1981, pp. 337-338						
	61.	L. Chen et al., "Thermal Wave Studies of Thin Metal Films Using the Meta-Probe-A New Generation Photothermal System" 25th Review of Progress in QNDE, Snowbird, UT 19-24 July, 1998, pp 1-12						
	62.	P. Alpern and S. Wurm, "Modulated Optical Reflectance Measurements on Bulk Metals and Thin Metallic Layers", J. Appl. Phys. 66(4), 15 August 1989, pp 1676-1679						

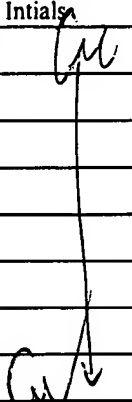
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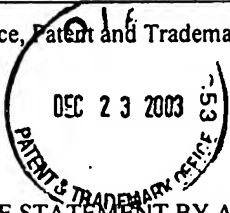
U.S. Patent Documents								
*Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate	
m	63.	5,667,300	9/16/97	Mandelis et al.	374	43	7	
	64.	4,521,118	06/00/85	Rosencwaig	374	5		
	65.	4,710,030	12/1/87	Tauc et al.	356	445		
	66.	5,074,669	12/1/91	Opsal	356	447		
	67.	3,909,602	9/30/75	Micka	235	151		
	68.	5,430,548	7/4/95	Hirio et al.	356	394		
	69.	5,764,363	6/9/98	Ooki et al.	356	364		
ant	70.	5,790,251	8/4/98	Hagiwara	356	351		
Foreign Patent Documents								
							Translation	
		Document	Date	Country	Class	Subclass	Yes	No
Other Art (Including Author, Title, Date, Pertinent Pages, Etc.)								
	71.	J. Opsal, "The Application of Thermal Wave Technology to Thickness and Grain Size Monitoring of Aluminum Films", SPIE Vol. 1596 Metalization Performance and Reliability Issues for VLSI and ULSI (1991), pp 120-131						
	72.	A. Rosenwaig, "Process Control In IC Manufacturing With Thermal Waves", Review of Progress in Quantitative Nondestructive Evaluation, Vol.9, 1990, pp 2031-2037						
	73.	K. Farnaam, "Measurement of Aluminum Alloy Grain Size on Product Wafers and its Correlation to Device Reliability", 1990 WLR Final Report, pp 97-106						
	74.	B.C. Forget et al., "High Resolution AC Temperature Field Imaging", Electronic Letters 25th September 1997, Vol. 33 No. 20, pp 1688-1689						
	75.	C. Paddock et al., "Transient Thermorefectance from Metal Films", May 1986 Vol. 11, No. 5 Optical Letters, pp 273-275						
	76.	C. Paddock et al., "Transient Thermorefectance from Metal Films", J. Appl. Phys. 60(1), 1 July 1986, pp 285-290						
	77.	Per-Eric Nordail et al. "Photothermal Radiometry", Physic Scripts, Vol. 20, 659-662, 1979						


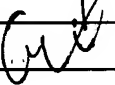
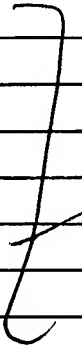
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	78.	5,657,754	8/19/97	Rosencwaig	128	633	
	79.	4,634,290	1/6/87	Rosencwaig	374	5	
	80.	4,552,510	6/11/85	Rosencwaig	374	7	
	81.	4,243,327	1/6/81	Frosch et al.	356	432	
	82.	3,930,730	1/6/76	Laurens et al.	356	106	
	83.	4,455,741	6/26/84	Kolodner	29	574	
	84.	4,468,136	8/28/84	Murphy et al.	374	45	
	85.	4,466,748	8/21/84	Needham	374	129	
Foreign Patent Documents							
							Translation
		Document	Date	Country	Class	Subclass	Yes No
Other Art (Including Author, Title, Date, Pertinent Pages, Etc.)							
	86.	A. Rosenwaig, "Thermal Wave Monitoring and Imaging of Electronic Materials and Devices", pp 73-109, (believed to be prior to March 01, 2002).					
	87.	A. Rosenwaig, "Applications of Thermal-Wave Physics to Microelectronics", VLSI Electronics, Microstructure Science Vol. 9, pp 227-288 1985					
	88.	W. Lee Smith et al., "Voids, Notches and Micro-cracks in Al Metallization Detected by Nondestructive Thermal Wave Imaging", June 23m 1989, pp. 211-221					
	89.	W. Lee Smith et al., "Imaging of Subsurface Defects in ULSI Metalization (Al Voids SI Precipitates, Silicide Instability) and SI Substrates (D Defects), Technical Proceedings Simicon/Japan 1992, Nippon Convention Center, Japan pp 238-246					
	90.	W. Lee Smith, "Nondestructive Thermal Wave Imaging of Voids & Microcracks in Aluminum Metallization", 1989 WLR Final Report, pp 55-68					
	91.	W. Lee Smith, "Direct Measurement of Stress-Induced Void Growth by Thermal Wave Modulated Optical Reflectance Imaging", 1991 IEEE/IRPS, pp 200-208					
	92.	W. Lee Smith, "Evaluating Voids and Microcracks in Al Metalization", Semiconductor International, January 1990, pp 232 -237					

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 	93.	5,408,327	4/18/95	Geiler et al.	356	532	
	94.	4,795,260	1/3/89	Schuur et al.	356	400	
	95.	6,559,942	5/6/03	Sui et al.	356	369	
	96.	6,336,969	1/8/02	Yamaguchi et al.	117	7	
	97.	6,528,333	3/4/03	Jun et al.	438	16	
	98.	6,081,334	6/27/00	Grimbergen et al.	356	357	
	99.	3,462,602	8/16/67	Apple	250	83	
	100.	5,149,978	9/22/92	Opsal et al.	250	234	

Foreign Patent Documents							Translation	
		Document	Date	Country	Class	Subclass	Yes	No

Other Art (Including Author, Title, Date, Pertinent Pages, Etc.)		
101.	C. G. Welles et al., "High-Resolution Thermal Wave Imaging of Surface and Subsurface Defects in IC Metal Lines", Materials Research Society, SF Marriott, April 27-May 1, 1992, pp 1187-1191	
102.	L. Fabbri et al., "Analysis of Local Heat Transfer Properties of Tape-cast AlN Ceramics Using Photothermal Reflectance Microscopy", 1996 Chapman & Hall, pp 5429-5436	
103.	J. A. Batista et al., "Biased MOS-FET and Polycrystalline Silicon Tracks Investigated by Photothermal Reflectance Microscopy", pp 468-469	
104.	L. Chen et al., "Meta-Probe: A New Generation Photothermal System For Thin Metal Films Characterization" (believed to be prior to March 01, 2002).	
105.	L. Chen et al., "Thermal Wave Studies of Thin Metal Films and Structures"	
106.	9th International Conference on Photoacoustic and Photothermal Phenomena Conference Digest, June 27-30, 1996 Nanjing, P.R. China, pp 81	
107.	R. S. Sharpe, "Research Techniques in Nondestructive Testing Vol. VII, Academic Press 1984, pp 158-365	
108.	R. L. Thomas et al., "Thermal Wave Imaging For Nondestructive Evaluation" 1982 Ultrasonic Symposium, pp 586-590	

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	109.	G. Slade Cargill III, "Electron-Acoustic Microscopy", Physics Today, October 1981, pp 27-32
	110.	A. Rosencwaig, "Thermal Wave Microscopy", Solid State Technology, March 1982, pp 91-97
	111.	Eric A. Ash, "Acoustical Imaging" Volume 12, Plenum Press, July 19-22, 1982, pp 61-65

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